United States Department of Energy

REPORT TO CONGRESS ON MAINTENANCE OF VIABLE DOMESTIC URANIUM, CONVERSION AND ENRICHMENT INDUSTRIES

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EXECUTIVE SUMMARY

This report is prepared in response to the Fiscal Year 2001 Energy and Water Development Appropriations Conference Report, House Report 106-907, which asked the Secretary of Energy to undertake an evaluation and make specific recommendations on the various options to support a domestic uranium enrichment industry in the short and long-term. The Department also included the domestic conversion and mining industries -- themselves important components of the nation's nuclear fuel cycle -- within this evaluation.

Nuclear energy represents about 20 percent of the nation's electricity supply. Uranium, a basic raw material, is transformed into nuclear fuel through distinct processing steps -- mining and milling, conversion, enrichment, and fuel fabrication. Over the last several years, the nation has seen a significant decline in the U.S. nuclear fuel market, including the closure of nearly all of the remaining domestic mines, possible near-term closure of the only U.S. plant capable of converting uranium to an acceptable form for processing in enrichment plants, and the announcement by USEC, Inc. to stop the AVLIS enrichment technology program and its intention to cease enrichment operations next summer at one of two GDPs in the United States.

In 1996, Congress enacted the Privatization Act, which authorized the USEC Board of Directors, with the approval of the Secretary of the Treasury, to proceed to transfer the Government's interest in USEC to the private sector, in a manner that "provides for the continued operation by the Corporation of the Department of Energy's GDPs, provides for the protection of the public interest in maintaining a reliable and economical domestic source of uranium mining, enrichment and conversion services, ..." The Act, under Section 3112, required the Government to provide annual reports to Congress on the status of the industries and to take or propose to take steps to "mitigate any material adverse impact or any loss of employment at the GDPs."

When the Secretary of Treasury approved the initial public offering of USEC in July 1998, it was based on, among other things, a short and long-term strategy for maintaining reliable and economic domestic enrichment: operation of both GDPs through 2004 and deployment of an advanced technology, Atomic Vapor Laser Isotope Separation (AVLIS), by mid-decade. These conditions and the viability of domestic enrichment were jeopardized when USEC cancelled AVLIS in June 1999 and last summer, announced the closure of the Portsmouth GDP in Ohio in June 2001.

This report analyzes the market conditions, the impact of a one-GDP operation on domestic energy security, and the short and long-term options for restoring the status of domestic energy security that existed when the government concluded that the initial public offering proposal by USEC satisfied the objectives of the Privatization Act. The Government evaluated the cost, schedule, technical and policy considerations of placing the Portsmouth GDP in either warm or cold standby or continuing to operate the plant to produce 3 million SWU/year for a strategic reserve. Similarly, the Department evaluated the range of advanced enrichment technology options that would be available for future domestic enrichment. A key portion of the Secretary's October 6 plan is the demonstration of U.S. origin technology in order to satisfy national security objectives. As such, detailed analyses of cost, schedule, and technical maturity and risk associated with the AVLIS and gas centrifuge advanced enrichment technologies were performed. The results of these analyses are largely contained in *Options for Government Response to Energy Security Challenges Facing the Nuclear Fuel Cycle,* Revision 2, September 2000.

On October 6, 2000, Secretary Richardson announced steps that the Department would take to address domestic enrichment security: placing the Portsmouth GDP in standby to protect 3 million SWU/year of enrichment capacity while gas centrifuge technology is demonstrated at the Portsmouth site as commercially viable and deployable. The Department expects to complete these missions by mid-decade.

Finally, over the last several months, the Department has completed analyses of the conversion and uranium markets, the impact of privatization as well as other market-related impacts on these industries, the basis for government response as well as options that could be pursued with the goal of maintaining a viable and economic domestic nuclear fuel industry for the future. A wide range of options were evaluated, including further reducing supply entering the markets, conducting cooperative research and development on needed environmental remediation technologies, utilizing Government stockpiles of uranium and conversion to assist industry in meeting existing and future sales, as well as, financial assistance to maintain the industry infrastructure while the market recovers from its severe oversupply condition.

As a result of the conditions of the nuclear fuel cycle markets and to help maintain viable domestic industries, the Department recommends that legislative action be taken to delay, for a five year period, the introduction of the remaining Department-held 1995 and 1996 natural uranium component from deliveries under the HEU Agreement (9.8 million pounds of natural uranium) into the market as currently required by the Privatization Act. In addition, the Department recommends conducting cooperative research and development on needed environmental remediation technologies with the uranium industry.

The Department will also work closely with the Congress and industry to address the economic condition of the conversion industry. Consistent with the legislative objective to ensure reliable and competitive domestic mining, conversion and enrichment industries, the Department recommends prompt consideration of limited financial assistance to the only U.S. convertor, ConverDyn. This assistance, which would contain a ceiling on both quantity and length of time over which it is provided, will be calculated based on an assessment of actual costs versus prices received from existing and new contracted sales. This initiative will help ensure the maintenance of the only U.S. supplier of conversion services and provide an incentive for ConverDyn to proceed with new production and sales.

As part of the preparation of this report, the Department solicited input from industry. The Department received valuable insight from the domestic utility industry as well as the domestic and foreign conversion and mining industries. During the process, the Department met with representatives of the Nuclear Energy Institute and their member organizations. Although there were a number of disparate views and interests reflected in the range of comments received, there was broad consensus on the importance of the HEU Agreement to U.S. nonproliferation interests, the global nature of market conditions, and that U.S. energy security would be adversely affected by the loss of the domestic enrichment industry. In general, there was broad support for Departmental plans to demonstrate an advanced enrichment technology -- gas centrifuge-- for future deployment and for government action to protect against domestic supply disruption.

REPORT TO CONGRESS ON MAINTENANCE OF VIABLE DOMESTIC URANIUM MINING, CONVERSION AND ENRICHMENT INDUSTRIES

INTRODUCTION

The Conference Report on FY 2001 Energy and Water Development Appropriations expressed concern about the continued viability of the front end of the domestic nuclear fuel cycle.[1] The Conferees asked that the Department work with the President and other federal agencies to ensure that the privatization of USEC and the implementation of "The Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Disposition of Highly Enriched Uranium Extracted From Nuclear Weapons" (HEU Agreement) were being carried out in accordance with the various laws enacted regarding these efforts. This report is a result of the Department's continuing evaluation of the domestic uranium mining, conversion, and enrichment industries. Included are short- and long-term options that were considered to help sustain the domestic enrichment industry, as well as recommendations for other actions that could be or are being taken to further support these industries while at the same time ensuring that the HEU Agreement continues to be implemented in support of important national security and nonproliferation goals.

Nuclear energy continues to represent about 20 percent of this nation's electricity supply. Participants in the front end of the nuclear fuel cycle compete to supply reactor fuel to many countries. While the front end of the nuclear fuel cycle represents only 25–30 percent of all maintenance and operating costs for a nuclear reactor, it represents a much larger percentage of all variable costs. As reflected in the Figure 1–1 below, enrichment represents about 50 percent of all front end nuclear fuel cycle costs.

Since the privatization of USEC in July 1998, the makeup of the nation's nuclear fuel industry and the nuclear fuel market has changed substantially. For a variety of reasons, the nation has seen a significant decline in the financial condition of USEC; the collapse of the U.S. uranium market, including the closure of nearly all of the remaining domestic uranium mines; and the possible closure of the only U.S. plant capable of converting natural uranium or yellowcake (U_3O_8) to uranium hexafluoride (UF_6), the form needed for processing in uranium enrichment plants. Moreover, USEC's announcement that enrichment operations will cease in June 2001 at the Portsmouth (GDP) in Piketon, Ohio (more than three years ahead of the earliest closure date indicated in the Treasury Agreement[2]) has raised questions as to whether there is sufficient insurance against a disruption in the domestic supply of enriched uranium.

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[1] The nuclear fuel cycle is a term used to describe all of the functions related to the production of nuclear energy. For this report, nuclear fuel cycle refers to the "front-end" of the nuclear fuel cycle (i.e., mining, conversion, and enrichment). The back-end of the nuclear fuel cycle refers to the management and disposition of spent fuel.

[2] Agreement Between the United States of America and the United States Enrichment Corporation Regarding Post- Closing Conduct dated July 14, 1998.

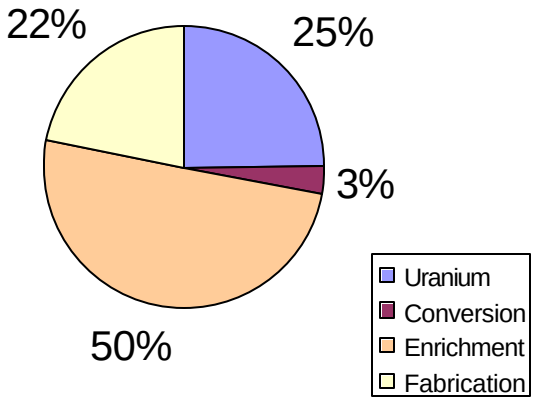

Figure 1–1. Breakdown of Nuclear Fuel Production Costs

This report focuses on issues related to the continued sustainability of the domestic uranium enrichment, conversion, and mining industries, and makes recommendations that may help these industries remain viable. The first section of the report addresses the domestic uranium enrichment industry, the status of the Portsmouth GDP, and actions that are being taken in the short- and long-term to support the continued viability of this industry, including options related to advanced enrichment technologies. Section 2 of the report discusses the state of the domestic mining industry and makes recommendations regarding its future economic viability. The third section of the report details the state of the domestic conversion industry and makes recommendations that could help to improve its sustainability. Section 4 discusses comments and suggestions received from industry and how they have affected the Department's consideration of these issues. Finally, Section 5 offers conclusions and recommendations for future activities that will help to ensure all of these industries remain viable.

1 STATE OF THE DOMESTIC URANIUM ENRICHMENT INDUSTRY

Closure of the Portsmouth GDP in June 2001 will increase our dependence on the performance of the remaining GDP at Paducah, Kentucky and increase the vulnerability of U.S. enrichment supply to disruptions in deliveries under the HEU Agreement. This section discusses (1) USEC's current contract commitments in the context of the world market; (2) energy security issues raised by relying on the Paducah GDP as the only domestic source of enrichment for the fulfillment of these commitments; (3) the role of commercial and government inventories in mitigating disruptions; (4) the relative impacts of disruption under various scenarios, including disruption of the HEU Agreement, on compliance with national energy security commitments; and (5) short- and long-term recommendations for improving the security and sustainability of the domestic enrichment industry.

1.1 USEC Commitments

Contract Commitments. USEC's current contract requirements are made up mainly of sales to U.S. utilities and to our allies in the Far East (i.e., Japan, Taiwan, and South Korea), as indicated in Table 1–1. The loss of ability to supply enrichment services to these customers would threaten our energy security and weaken U.S. nonproliferation commitments.

Table 1–1. USEC Contract Requirements

	USEC Sales (MSWU)	As % of USEC Sales	USEC Share of Regional Markets (%)
United States	6.8	62	69
Far East	3.3	30	52
Europe and Other	0.9	8	6

Covering Demand. The United States needs to be able to reliably meet the continuing demand for approximately 11 million separative work units per year. Today, there is sufficient capacity available to fill this demand if deliveries under the HEU Agreement are discontinued, as suggested in Table 1–2.

Table 1–2. Contract Commitments Under the HEU Agreement

Production Site	Demand Filled (MSWU)	Reserve Capacity (MSWU)
Paducah & Portsmouth GDPs	5.5	≅ 8.0
HEU Agreement	5.5	0*
Total	11.0	≅ 8.0

* Russia could supply more SWU only through government-to-government renegotiation of the HEU Agreement, taking into account Congressional and domestic concerns.

When enrichment activities at the Portsmouth GDP cease, as USEC plans in mid-2001, Paducah will be left as the lone operating U.S. GDP. This assumes that Paducah is licensed by the U.S. Nuclear Regulatory Commission (NRC) to perform enrichment up to 5 percent. Paducah has heretofore never produced commercial assay material, acting instead as a feeder plant to Portsmouth. USEC anticipates receiving the Paducah license in the spring of 2001 and has asserted an approximately 8 million SWU nameplate capacity at 5 percent enrichment. Certain technical issues, not yet fully understood, raise questions about Paducah's ability to achieve the full 8 million SWU at commercial assays.

World Market Context. With the closure of Portsmouth, the total world enrichment capacity will be approximately 40 million SWU; this includes both the 8 million SWU at Paducah and 5.5 million SWU equivalent from the HEU Agreement (see Table 1–3) Current world enrichment requirements are about 35 million SWU, with various estimates

ranging between 34 and 37 million SWU. Thus, the closure of Portsmouth significantly tightens the world SWU market and places additional importance on the uninterrupted delivery of material under the Russian HEU Agreement.

Table 1–3. Contributions of the Paducah GDP and HEU Agreement to SWU World Market

Production Site	Demand Filled (MSWU)	Reserve Capacity (MSWU)
Paducah GDP	5.5	$\leq$ 2.5
HEU Agreement	5.5	0
Total	11.0	$\leq$ 2.5

1.2 Energy Security Concerns Related To the Portsmouth Closure

USEC's decision to discontinue enrichment activities at the Portsmouth GDP in the summer of 2001 raises a number of concerns regarding the security of supply for enrichment. Among these are the following:

Advanced Technology Development, Demonstration and Deployment. When USEC was privatized in July 1998, the Atomic Vapor Laser Isotope Separation (AVLIS) technology was targeted for deployment by 2005 in order to provide a reliable, economical domestic enrichment capacity for the long term. When USEC discontinued the program in June 1999, citing technical and economic concerns, the United States was left without any advanced enrichment technology development program, public or private. Without an advanced enrichment technology development program, it will be impossible to sustain the domestic uranium enrichment industry in the long-term.

Increased Reliance on the HEU Agreement. There have been many difficulties associated with implementing the HEU Agreement. On five different occasions, deliveries under the HEU Agreement have been suspended for various periods of time. Subsequent agreements have helped to resolve these problems; however, issues continue to be raised that could lead Russia to withdraw from the HEU Agreement or prompt a prolonged delay in deliveries. The numerous political, national security, and commercial interests involved pose a continuous challenge to the long-term performance of the HEU Agreement. If circumstances were to cause Russia to suspend or cancel the HEU Agreement, the implications for enrichment supply disruptions in the United States could be serious. Deliveries of uranium from Russia, therefore, should not be considered as part of the long-term solution for maintaining a domestic source of enrichment services, however vital.

Paducah GDP Technical Concerns. Before the Paducah GDP can operate as a stand-alone enrichment source able to meet domestic requirements, it requires an NRC amendament of USEC's operating certificates to produce enrichment at 5.5% U-235. Issues have been raised about Paducah's ability to reach 8 million SWU at commercial assays. This issue, which is related to managing the content of lighter isotopes in order to meet commercial fuel specifications, is being examined. Also, Paducah is an old plant that could be prone to future operating problems.

However, it is important to note that the plant has been quite reliable to date and, therefore, this analysis assumes its continued successful operation in meeting USEC's needs.

Financial Viability. The cessation of enrichment activities at the Portsmouth GDP could theoretically, provide a near-term improvement in USEC's financial condition. However, a variety of analyses have pointed to significant challenges to USEC's long-term viability as a provider of enrichment services unless it has a clear plan for developing an advanced enrichment technology. In addition, expiration of the statutory restrictions on the ownership of USEC in 2001 could provide additional uncertainty about the company's future if its ownership changes substantially. The level of uncertainty, of course, is dependent upon the new ownership's business strategy.[3]

1.3 Role of Inventories and Alternative Enrichment Suppliers

As insurance against enrichment supply disruptions, USEC and some of its customers carry inventories of SWU that can be used as needed in an emergency. The following discusses the status of these inventories:

USEC Inventories. It is estimated that USEC currently maintains an inventory of approximately 5 million SWU, or enough SWU to cover about 1 year of production should either Paducah or the HEU Agreement experience delivery problems. USEC also has 3.3 million SWU in the form of 48 metric tons (t) of HEU that is being blended down at BWX Technologies, in Virginia, between now and 2006, and thus is not considered readily available for use in the short term.

Commercial Utility Inventories. Utilities are estimated to be carrying inventories of approximately 3 million SWU, but this level is considered insufficient to offer much in terms of insurance from supply disruptions. The utilities that carry these inventories are not expected to be interested in selling the material, especially in the event of a supply disruption. Over the past years, the inventory of SWU being carried by utilities has been reduced to avoid holding costs, and many utilities have transitioned to more of a just-in-time inventory system in an effort to reduce inventory costs.

Government Inventories. The U.S. Government also has inventories of about 56 metric tons of surplus HEU (roughly 6.2 million SWU) suitable for ultimate commercial disposition as low-enriched uranium (LEU); of that, 10 metric tons (1.8 million SWU) is in the form of HEU metal at Oak Ridge and would likely represent the earliest available source of inventory after downblending, although no near-term funds are budgeted for that purpose. Downblending the entire 56 metric tons would require approximately 4 years and cost roughly $50 million per 1 million SWU or a total of about $300 million.

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[3] Section 3111(b) of the Privatization Act limits "the beneficial ownership of securities" to less than 10 percent of the "total votes of all outstanding voting securities of the corporation" for a period of 3 years (i.e., until the summer of 2001).

Foreign Suppliers of Enrichment. There may be additional enrichment capacity available in Europe, but the ability to quickly increase European production to meet any shortfall is uncertain. At the present time, Eurodif (France's enrichment entity) and Urenco (jointly owned by Britain, Germany, and Holland) are operating close to their actual capacities. While the Eurodif plant is capable of operating at approximately 11 million SWU per year, it does not currently have access to the electricity needed to operate at that level. Urenco is operating at or very near its capacity, producing approximately 4.5 million SWU per year in three plants, with the capacity to produce only about 5 million SWU per year. Given the nature of Urenco's centrifuge plants, additional capacity could be added incrementally, but it would take an estimated 2–3 years. Urenco has not expressed any interest in building up its capacity to serve the U.S. market. Russia has a significant amount of estimated excess capacity available because it is only using approximately 8 million SWU per year of an estimated 15 million SWU per year capacity. However, should Russian deliveries to the United States under the HEU Agreement cause a disruption in domestic supply, deliveries of additional SWU from Russian enrichment plants would likely be jeopardized.

1.4 Legal and Policy Requirements

The Department is faced with a number of reasons for ensuring that the United States retains an adequate domestic enrichment capacity to address its national interests:

USEC Privatization Act. The USEC Privatization Act, Public Law No. 104-134, Title III, Section 3103 (1996), 110 Stat. 1321-336, 42 U.S.C. 2297h-1(a), authorized the privatization of USEC in a manner that provided: "for the protection of the public interest in maintaining a reliable and economical domestic source of uranium mining, enrichment and conversion services." In addition, the President is charged with making annual reports on the status of these industries and, if necessary, describing or proposing steps to "mitigate any material adverse impact or any loss of employment at the gaseous diffusion plants..." that may be caused by low-enriched uranium deliveries under the HEU Agreement (Public Law No. 104-134, Title III, Section 3112 (b)(10) (1996), 42 U.S.C. 2297h-10(b)(10)).

Section 3108(a) of the USEC Privatization Act, 42 U.S.C. 2297h-6(a), transferred all existing contracts, agreements and leases for enrichment services to USEC. Section 3108(c)(1) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c), states that notwithstanding that transfer, the United States remains liable for the performance of those obligations, whether the government acts directly or through the private corporation.

Section 3108(c)(2)(A) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c)(2)(A), allocates liability to USEC for any obligations arising after the date if extension or material amendment of any contract, agreement or lease that USEC terminates, extends or materially amends. Section 3108(c)(2)(B) of the USEC Privatization Act, 42 U.S.C. 2297h-6(c)(2)(B), allocates liability to the United States for any obligation arising before the date of termination, extension or material amendment of the date of extension or material amendment of any contract, agreement or lease by USEC.

Nuclear Non-Proliferation Act. The Nuclear Non-Proliferation Act of 1998, Public Law No. 95-242, Title I, Section 101, 92 Stat. 121, 22 U.S.C. 3221, provides that:

> The United States, as a matter of national policy, shall take such actions and institute such measures as may be necessary and feasible to assure other nations and groups of nations that may seek to utilize the benefits of atomic energy for peaceful purposes that it will provide a reliable supply of nuclear fuel to those nations and groups of nations which adhere to policies designed to prevent proliferation.

Uranium enrichment involves the use of classified technology, and a reliable source of supply dampens the incentives for the spread of this technology, which can be used in fissile material production and weapons applications.

Energy Security Needs. Nuclear energy supplies one-fifth of the U.S. electricity requirements and is a significant source of electricity in Japan, South Korea, and Taiwan, all of which rely heavily on the United States for their enrichment requirements.

National Security and Foreign Policy. U.S. law, policy, and international agreements have enabled increasing imports of Russian enrichment and conversion services and uranium into the United States under the HEU Agreement in the interest of providing ongoing incentives for Russia to rid itself of HEU from nuclear weapons. At the same time, neither the United States nor the goals and objectives of the HEU Agreement would be well served if the United States were to become dependent on Russian enrichment industry in the process.

Nuclear Stockpile. It is necessary to sustain the U.S. enrichment capability (using U.S.-origin uranium and enrichment technology) in order to meet tritium requirements for maintaining the nuclear stockpile at levels set by the President through the Nuclear Weapons Council. The use of non-U.S.origin enrichment technology violates bilateral agreements with foreign countries that involve commitments not to use their uranium or enrichment services for weapons-related purposes.

1.5 Impacts of Supply Disruptions on Energy Security

If USEC were to permanently lose the SWU delivered under the HEU Agreement or lose the ability to deliver SWU from Paducah, the balance of USEC's contracts would have to be filled by available worldwide excess capacity after modest inventories were liquidated. The net effect would be a significant reduction in current worldwide enrichment capacity. This would likely place a strong upward pressure on SWU prices in the short-term until additional capacity was available to increase competition among the remaining enrichment suppliers. With only one enrichment plant operating, the security-of-supply risk would be greater for both domestic and non-U.S. customers under contract to USEC if there were a supply disruption stemming from the HEU Agreement or major problems (e.g., operations, economics, natural disaster) at the one remaining plant.

Obviously, once the Portsmouth GDP ceases enrichment activities, the implications of disruption in supply become more troublesome. For example, the domestic shortfall if Russian HEU deliveries were suspended, is summarized in Table 1–4. Should unanticipated operational problems at the Paducah GDP make it impossible to increase its production to 8 million SWU per year, any such shortfall would be significantly larger.

Table 1–4. Domestic HEU Shortfalls Attributable to Suspension of Russian Deliveries (in MSWU)

Effect of Russian Failure to Deliver SWU	Year				
	One	Two	Three	Four	Five
U.S. Supply Disruption	–5.5	–5.5	–5.5	–5.5	–5.5
Increased Paducah Production	≤ 2.5	≤ 2.5	≤ 2.5	≤ 2.5	≤ 2.5
USEC Inventories	3.0	2.0	0.0	0.0	0.0
USEC Shortfall	≤ 0.0	≤ 1.0	≤ 3.0	≤ 3.0	≤ 3.0

To address concerns associated with potential disruptions, the Department is moving to place the Portsmouth GDP in a standby condition with the capability to resume operations at approximately 3 million SWU per year within a period of 18 months to 2 years. For the longer term, the Department is restarting development of an advanced enrichment technology. The following section of this report discusses these activities.

1.6 Options for Improving the Sustainability of the Domestic Uranium Enrichment Industry

This section examines both short and long-term options for improving the sustainability of the domestic uranium enrichment industry. In the short term, options examined include continuing operation of the Portsmouth GDP for a limited period of time or placing it in standby, warm or cold. For the longer term, the Department considered options related to the development of an advanced enrichment technology. Some consideration was given to examining existing foreign technologies such as Russian or Urenco design centrifuges or the SILEX technology, but none would satisfy the Department's national security concerns relating to the ability to maintain a U.S.-origin source of tritium or national security material. Consequently, they were dropped from further consideration.

1.6.1 Short-Term Options

Each of these options were examined from the standpoint of their ability to ensure against a disruption in the supply of enriched uranium. Continued operation of the Portsmouth GDP would help to create a strategic reserve of enriched uranium equal to 6 million SWU, while standby would preserve the capacity to restart the plant should conditions warrant such an action. Each of these options is based on retaining the capability to produce 3 million SWU per year.

1.6.1.1 Operation of the Portsmouth GDP for 2 Years

Under this option, the Department would continue to operate the Portsmouth GDP for 2 years to build up an inventory of 6 million SWU that could be used to offset future supply disruptions. This would allow the Department to build up

an inventory that would cover approximately a 1-year supply disruption associated with the HEU Agreement or Paducah should either be unable to deliver SWU for a year. The advantage of this option is that it would allow the plant to continue to operate for 2 years, taking advantage of current staff experience to build up the SWU inventory. At the end of the 2-year operating period, the plant would be shut down permanently. The disadvantage of this option is the cost associated with continuing to operate the plant at a low level of production for the purpose of creating an SWU inventory that may never be needed. It was estimated that this option would cost the Department over $685 million over a 2-year period beginning in the summer of 2001.

1.6.1.2 Warm Standby

The warm standby option requires placing those portions of the Portsmouth GDP needed for 3-million SWU-per-year production capacity in a recycle mode at a 200-MW power load. Some cells would continue to operate while other cells required for production at a 850-MW power load (i.e., a 3 million SWU-per-year capacity) would be maintained in a fully buffered shut-down status ready to restart as needed. In the recycle operation, essentially no feed is needed nor is product withdrawn. In this state, the GDP could be ready, and would be currently authorized, to resume operations at a 3 million SWU-per-year capacity within approximately 2 months. Staffing of approximately 1,100 personnel would be needed to support a four-shift operation for this scenario. Thus, according to estimates, it would cost the Department about $100 million to place the facility in warm standby and about $120 million per year to keep it in that state.

1.6.1.3 Cold Standby

Cold standby requires placing those portions of the Portsmouth GDP needed for 3 million SWU-per-year production capacity in a shut down, nonoperational condition, and performing the surveillance and maintenance activities necessary to retain the ability to resume operations should it be required due a significant disruption in domestic enrichment supply. This was determined by the Department to be the most appropriate option for maintaining the Portsmouth GDP in a usable condition until a longer-term option was available to help sustain the country's uranium enrichment capability. This was also determined to be the most economical of the short-term options considered. According to estimates, the cold standby option would cost about $210 million (including costs for standby operations as well as ongoing and remaining GDP surveillance and maintenance).

It is estimated that it would take a maximum of 18–24 months to bring the plant back on-line under this option. Several activities would be required in order to shut down the cascade cells and retain them in a condition suitable for cold standby, including:

- Additional treatments to remove uranium deposits in certain portions of the cascades
- Buffering of process cells with dry air to prevent wet air inleakage
- Installation of buffer alarms on nonoperating cells to ensure that proper system integrity is maintained
- Revision of operating and maintenance procedures

In cold standby, the feed and withdrawal systems would also be in standby. In addition to the surveillance and maintenance staff needed to monitor the facilities, a single day shift of operations and maintenance personnel would be retained. These personnel will serve as a core cadre of cascade operators, utilities operators, and maintenance staff, forming the basis for future GDP restart, operations, and maintenance. Therefore, under this option the power load and staffing are significantly decreased. Cold standby would require only about 15 MW of additional electrical power over present DOE power needs. To support the cold standby option, the Department would also need to keep the cooling water systems in operating status to keep cooling towers wet, maintain Freon inventories, and support associated lube oil systems.

A decision to restart the GDP would require a significant level of effort in order to return the facility to operational status, including major updates to the Safety Authorization Basis; hiring and training of operations and maintenance personnel; recharging all coolant systems with Freon; returning auxiliary support systems to full operational status; operational readiness reviews; and ultimately authorization to restart and operate.

1.6.2 Long-Term Options

The Department considered two possible advanced technology options for further uranium enrichment development work: the AVLIS process and an advanced gas centrifuge technology. These technologies were part of prior research and development (R&D) programs operated by the Department. Demonstration of either technology presumes the use of the former gas centrifuge enrichment plant (GCEP) facilities at the Portsmouth site. Non-U.S. origin technologies, e.g., SILEX, were considered by the Department and dismissed due to national security concerns, as discussed briefly in the introduction to Section 1.6.

1.6.2.1 Atomic Vapor Laser Isotope Separation

The AVLIS process is an enrichment technology that was investigated by DOE and subsequently by USEC for potential use to enrich uranium. In June 1999, USEC announced that it was discontinuing its development of the AVLIS process. While USEC owns the AVLIS technology, the Department retains the right to utilize the intellectual property for government purposes.

When USEC terminated development of the AVLIS technology, it argued that the rates of return were not sufficient to outweigh the risks and ongoing capital expenditures necessary to develop and construct an AVLIS production plant. USEC had spent about $100 million in development of the technology since the corporation was privatized in July 1998.

Under this option, the AVLIS enrichment process would be demonstrated at Portsmouth as a means to complete the engineering development of the AVLIS process and demonstrate the commercial potential of this technology. Demonstration of this technology at Portsmouth would include construction of a separator reliability engineering test facility, as well as a 500,000 SWU per year demonstration plant representing a single line separator facility. The goal for the separator testing would be to extend separator life sufficiently above past test results to ensure adequate economic performance of the technology.

Demonstration of the technology would also involve dismantling remaining equipment at Lawrence Livermore National Laboratory (LLNL) and shipping it to Portsmouth for reactivation at that site. Consistent with the goal of successfully transferring the technology, Portsmouth personnel would assume the project lead providing key engineering and operations personnel. LLNL personnel would play a technology transfer and scientific support role.

It is estimated that it would take at least one year to reconstitute the technical expertise at Portsmouth and another 2.5 years before a separator reliability engineering test facility would be ready to operate. Separator reliability testing and development would be completed within
5.5 years. In addition, it would require 3.5 years to construct the demonstration plant. All together, this technology could be operational on a demonstration-scale at Portsmouth within 9 years.

The estimated cost to develop AVLIS is $659 million. In addition, the Portsmouth GDP would be kept in cold standby for at least 4 years longer than the gas centrifuge option at an estimated cost of about $47 million. As a result, and in light of concerns about the continued technical uncertainty surrounding the AVLIS process, development of the advanced gas centrifuge option for the long-term sustainability of the domestic uranium enrichment industry appeared to be the best option.

1.6.2.2 Advanced Gas Centrifuge

The gas centrifuge enrichment process was investigated by the United States over several decades until the mid-1980s and is currently used in a number of enrichment plants around the world. The Department and its predecessor agencies previously conducted R&D on gas centrifuge technology at Oak Ridge, Tennessee. Parts of this infrastructure and equipment, components, and expertise still exist there. Additionally, under the U.S. Gas Centrifuge Program, the government designed, constructed, and operated portions of a GCEP at Portsmouth. Although the GCEP was canceled in 1985 in favor of the AVLIS program, it was not canceled before portions of the GCEP had been successfully demonstrated. Much of the GCEP facilities, equipment, components, and expertise still exist at the Portsmouth site.

One factor in the decision to terminate development of the gas centrifuge was that the costs to enrich uranium were projected to be unfavorable when compared to projected costs for the AVLIS process. An element of the high cost of the gas centrifuge process was the cost of equipment and materials. Since 1985, there have been significant improvements in the properties of high-strength, light-weight materials, while the cost of these materials has dropped by about a factor of four. As a result there is the prospect that the use of these materials can dramatically improve the economics of gas centrifuge technology, making it attractive for commercial uranium enrichment. However, some design, development and verification testing is needed to demonstrate the projected performance and costs. The goal of the proposed gas centrifuge development activity would be to design an advanced gas centrifuge using new materials, to demonstrate the improvement in enrichment performance of the new design, and to collect and assess reliability and operability data to establish the potential economic performance of this technology on a commercial scale.

Under this option, a 70,000 SWU per year demonstration plant would be constructed. This represents the capacity needed to establish the commercial potential of the technology including all aspects of balance of plant design and operation given an aggressive one-year testing schedule. The pilot facility would be housed in the former GCEP facilities at the Portsmouth site. These facilities were built to house centrifuges of the scale that will be developed. To the extent possible existing GCEP equipment and components would be utilized. Engineering development of this technology would continue over 5 years using the specialized centrifuge test facilities available at the East Tennessee Technology Park in Oak Ridge. While most of the development work would be conducted by ORNL personnel, a significant number of Portsmouth personnel would be brought to Oak Ridge to allow the transfer of the technology and to support the manufacture and testing of the machines. Upon their return to Portsmouth they would lead and train others in the manufacture and operation of the pilot plant machines. Reliability operations would start at Portsmouth in mid–FY 2004, with the goal of attaining full capacity of the 70,000 SWU per year demonstration plant commensurate with start of operation. Operations would continue through March 2005.

The estimated cost to develop the gas centrifuge technology is about $255 million. Under this option, the Portsmouth GDP would be kept in cold standby for at least 5 years while the gas centrifuge demonstration plant is undergoing construction and testing.

1.7 Uranium Enrichment Options Summary

On October 6, 2000, the Secretary announced the Administration's plan to build an advanced centrifuge demonstration plant for uranium enrichment at the Portsmouth GDP. This will address some of the long-term concerns associated with the domestic uranium enrichment industry. This advanced centrifuge technology, which uses only a fraction of the electricity required for gaseous diffusion, will ultimately be made available to the industry for deployment in hopes of reviving the United States' leadership in the field of uranium enrichment. To facilitate the ultimate commercialization of the gas centrifuge technology, the Department will seek private participation. The Department will establish a Gas Centrifuge Technical Review Committee to perform independent reviews of the technology and the programmatic strategies for development, design and demonstration of gas centrifuges as a means to improve the probability of successful demonstration of the technology. The Committee will provide independent review comments on overall program risk, suitability and comprehensiveness of the program plan including cost and schedule objectives, technical issues and technical risk.

Central to the Administration's long-term plan is placing and maintaining the Portsmouth GDP in a cold standby condition pending the successful demonstration of the advanced technology, in about 5 years. This plan allows the plant to be available for restart, within 18 to 24 months, in the event of a disruption in the nation's supply of enriched uranium. Together, this strategy will ensure the retention of vital nuclear expertise and skills. Many of the highly trained and qualified workers at the Portsmouth GDP will be continued to be employed under this plan, either maintaining the facility in a standby condition or being trained in the operation of the advanced gas centrifuge demonstration plant.

These plans by the Administration, which conclude months of analysis by departmental officials, is regarded as essential to the long-term health and competitiveness of the domestic uranium enrichment industry, and to the security of the nation's long-term supply of electric power. The overall plan addresses the congressional objective to maintain a viable domestic enrichment industry.

Detailed plans for placing the Portsmouth GDP into cold standby and governing the development of the centrifuge are being prepared and are expected to be finalized in February 2001.

2 STATE OF THE DOMESTIC URANIUM MINING INDUSTRY

As a result of a significant decline in price over the past 5 years, U.S. uranium production is currently about 10 percent of peak historical production–4.6 million pounds U_3O_8 in 1999 versus 43.7 million pounds U_3O_8 in 1980.[4] For 1999, the quantity of U.S. production was equivalent to 8 percent of U.S. reactor requirements.[5] The three largest U.S. producers, each 100 percent foreign-owned, accounted for about 70 percent U.S. production in 1999.[6]

The decline in U.S. production has been offset principally by imports. In 1999, 76 percent of U.S. demand was met by imports.[7] The largest foreign suppliers of uranium delivered to U.S. utilities in 1999 were Canada, Australia, and Russia. That portion of U.S. reactor requirements not filled by domestic production or imports was filled by drawing down utility and supplier inventories.

Further cuts in U.S. uranium production are planned. Power Resources, Inc., announced in September 2000 that it would scale back production at its Highland in-situ leach mining project in Wyoming from 700,000 pounds U_3O_8 in 2001, to 300,000 pounds by 2003. The company also plans to suspend developing additional reserves at the project site.

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4 Source of U.S. production data in aggregate and status of mine and mills–EIA, *Uranium Industry Annual* 1999 and 1993.

5 U.S. reactor requirements for 1999 are equal to uranium in fuel assemblies loaded into U.S. commercial nuclear power reactors (EIA, *Uranium Industry Annual* 1999, Table 27).

6 Source of production data for individual facilities–*Cameco Corporation Annual Report 1999*, and *Rio Algom Corporation Annual Report 1999*.

7 EIA, *Uranium Industry Annual 1999*, Table 17.

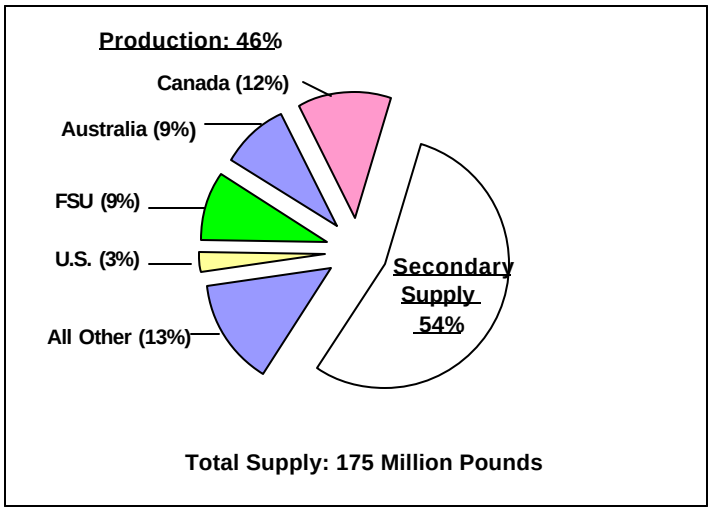

Figure 2-1. Uranium Supply to Meet World Requirements, 1999

2.1 Market Trends and Analysis

The U.S. uranium mining industry competes with production from the Australia, Canada, countries of the Former Soviet Union (FSU), and other countries, and with secondary supplies–stockpiles and inventories held by utilities; commercial suppliers, including USEC; and governments.

Because of relatively low cost of sales, secondary supplies have displaced a considerable amount of uranium production capacity since about 1980. For example, new mine production worldwide in 1999 was 81 million pounds out of world uranium requirements of 175 million pounds U_3O_8 (only 46 percent). The balance of 94 million pounds U_3O_8, or 54 percent of requirements, had been supplied from secondary sources (see Figure 2-1).[8]

Secondary supply includes the following sources:

Drawdown of U.S. Utility Inventories. Through sales and internal use, U.S. utilities have significantly decreased their uranium inventories, thereby displacing the demand for U.S. production.

Uranium Sales from the FSU. In the late 1980s, the FSU began selling uranium to Western countries. U.S. and other Western producers claimed that the FSU was selling uranium at prices that were far below fair market value. Beginning in 1991, the United States and the Europe took measures to mitigate the detrimental effects of

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[8] Based on uranium requirements of 175 million pounds U_3O_8 equivalent per EIA, International Nuclear Model PC Version, Reference Case 2000, April 2000 (http://www.eia.doe.gov/cneaf/nuclear/n_pwr_fc/data98/annura.html, December 6, 2000) and world uranium mine production of 81 million pounds U_3O_8 per Uranium Institute, (http://www.uilondon.org/coreissues/stats/uprod.html, December 6, 2000).

FSU sales on their domestic nuclear fuel cycle industries. In 1992, Department of Commerce signed initial agreements with Kazakhstan, Russia, and Uzbekistan placing quotas on imports from these countries. Although the suspension agreements have restricted deliveries of FSU-origin uranium to U.S. utilities, the sale of low-cost FSU uranium to Europe and Asia displaces the market share of other foreign suppliers. These producers could then utilize uncommitted capacity to compete in the U.S. market.

Drawdown of European Utility and Supplier Inventories. Inventories from Europe declined slightly in 1998 and 1999, after having been built up significantly in earlier years. Inventories were built up largely from imports from FSU countries. While the quantity of European uranium involved in the inventory drawdown is thought to be significant, no data on European inventories have been published.

Drawdown of Utility Inventories in Asia. For security of supply considerations, utilities in Asia typically hold a quantity of inventory to cover several years of future requirements. However, Asian utilities began to re-evaluate inventory policies during the latter half of the 1990s and subsequently reduced their uranium inventory reserve levels, resulting in less demand for uranium in the marketplace.

HEU Agreement. Pursuant to the HEU Agreement, the blending down of HEU contained in surplus Russian nuclear warheads to LEU would supply the world market with the equivalent of nearly 400 million pounds U_3O_8 through 2013. The HEU Agreement, to date, has not been a major contributing factor to the decline of the domestic uranium industry. However, due to the large quantities of uranium, conversion and enrichment, it is expected to be a major source of supply over the next 20 years. The impacts of these quantities of uranium entering the world and domestic markets are expected to be mitigated by the Privatization Act's quota provision that serves to restrict the amount of Russian HEU feed that can be delivered to U.S. end-users.

USEC Inventories. From 1993 through 1998, the DOE transferred about 172 million pounds of uranium in the form of natural UF_6 to the United States Enrichment Corporation in order to meet requirements under the Energy Policy Act of 1992 (EPACT) and the Privatization Act. Of the total 172 million pounds U_3O_8 equivalent transferred, approximately 99 million pounds U_3O_8 was uranium feed held by the Department, but owned by various enrichment utility customers . The remaining amount of approximately 73 million pounds U_3O_8 represents the Department's transfers of DOE-owned uranium to USEC. Forty-two million pounds U_3O_8 or about 57 percent of the 73 million pounds U_3O_8 of DOE-owned uranium is restricted by law or agreement in the manner in which it could be introduced into the uranium market. Lately USEC has, through public statements, recognized the perils of selling in a weak market. In reporting its earnings for the quarter ending September 30, 2000, USEC states "the short-term spot market for new natural uranium sales is soft, and the Company is focusing on longer-term sales where the prices are higher."[9]

DOE Inventories. DOE's surplus inventories consist of (1) natural uranium from DOE purchases of the 1995-1996 and 1997-1998 deliveries under the HEU Agreement (Russian HEU feed), and (2) natural uranium and HEU declared

[9]USEC Inc., "USEC Inc. Reports First Quarter Fiscal 2001 Earnings," press release, October 25, 2000.

as surplus to U.S. defense purposes.[10] As part of a commitment to minimize the impact of inventory sales on the market, the Department has agreed not to begin selling 58 million pounds U_3O_8 for a 10-year period (1999 through 2008 as agreed to under the Feed Agreement between Russia and the United States signed in March 1999). The content of this stockpiled uranium is equally divided between the 1997-1998 Russian HEU feed and U.S. Government surplus natural uranium and HEU.

2.2 Why Is It Important for the United States to Maintain a Viable, Domestic Uranium Mining Industry?

A viable domestic uranium-mining industry is important for the following reasons:

- It offers diversification of supply for domestic and foreign utilities that rely on the U.S. for nuclear fuel.
- It provides domestic utilities with the confidence to reduce inventories that would have been held to ensure security of supply, thus improving their efficiency.
- The majority of current uranium requirements are met through secondary supply sources. As inventories are depleted, new production will be needed.
- Domestic in situ leach technology and production are competitive with foreign suppliers. A minimal investment is required to support a vital U.S. industry.
- A viable domestic mining industry ensures a fully integrated U.S. nuclear fuel cycle industry.

2.3 Proposed Assistance to Industry Reviewed by the Department[11]

The Department has vigorously pursued alternatives to help revitalize the uranium industry and allow it to be a competitive and reliable supplier to the world market. In this respect, the Department has reviewed proposals such as the following:

- Reducing the supply of uranium entering the market from U.S. Government inventories, including delaying the commercial sale of surplus inventories and the congressionally mandated sale of the natural uranium feed component from the HEU Agreement that was purchased by DOE pursuant to provisions of the Privatization Act (remaining amount is about 9.8 million pounds of natural UF_6).
- Using the Department's surplus UF_6 inventories to help the domestic industry meet existing and new sales of U.S. uranium.

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[10] Privatization Act (April 1996), Section 3112 (d).

[11] While the Department reviewed and considered these options, not all options are recommended for implementation. Please see section 5 for the Department's recommended options.

- Purchasing remaining USEC uranium inventories for storage by DOE for a 5-year period. The uranium would then be resold into the market in a reliable, low-volume manner (not greater than 4 million pounds per year), thus allowing market prices to recover.

3 STATE OF THE DOMESTIC CONVERSION SERVICES INDUSTRY

Uranium conversion services are required to change uranium oxide (U_3O_8) from mines and mills to uranium hexafluoride (UF_6). UF_6 can be enriched into the type of fuel used by light water reactors in the United States and other parts of the world. The only U.S. uranium conversion facility is operated by ConverDyn at Metropolis, Illinois. A second uranium conversion facility had been operated by Sequoyah Fuels, a subsidiary of the Kerr-McGee Corporation, at Gore, Oklahoma until 1992.

ConverDyn, a 50-50 joint venture between General Atomics, a privately held U.S. integrated nuclear fuel supply and services company, and General Electric, one of the largest publically traded U.S. companies. General Atomics also owns the Beverly mine, a uranium mine in Australia that began production in late 2000. In November 2000, General Electric acquired its share of ConverDyn. General Electric is also involved in nuclear fuel fabrication and nuclear reactor design and engineering businesses.

In 1999, ConverDyn utilized 9.3 million kilograms of uranium (kgU) capacity out of the licensed capacity at Metropolis of 12.7 million kgU. In addition to the overall downturn in the market described below, ConverDyn's less-than-full capacity utilization resulted from additonal factors such as:

1. The converter's location relative to its enrichment supplier. ConverDyn, the only U.S. converter, is highly dependent on USEC sales of enrichment services. According to ConverDyn, 99 percent of the Metropolis plant's output is enriched by USEC.[12]

2. Since USEC has lost market share in the enrichment market. As a result, ConverDyn has experienced corresponding loss of market share.

3. Another indirect but less-significant cause of ConverDyn's difficulty has been the continued strength of U.S. dollar relative to the competing currencies in Canada and Europe.

It is also important to note that Cameco Corporation, a Canadian company and ConverDyn competitor, is vertically integrated in uranium mining and conversion services. It operates some of the world's highest quality uranium mines. Cameco, along with Cogema and Nukem Inc., have a commercial contract with Russia for the marketing of Russian HEU feed including the conversion services component.

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[12] ConverDyn, Letter from James J. Graham, President and CEO of ConverDyn to Senator Mitch McConnell, dated November 20, 2000.

3.1 Market Trends and Analysis

The conversion services market, like the uranium market, has suffered downward pressure on price and severely depressed market conditions for the past several years. As seen in Figure 3–1, the price for conversion services has fluctuated considerably since the early 1980s. With the closure of the Sequoyah Fuels facility in 1992, the conversion services spot-market
price moved upward to a new high and maintained a level of close to $6.00 per kgU through 1997.[13] After 1997, the spot-market price began its quick decline to $2.30 per kgU by August 2000. However, the declining price trend may have been reversed–the price of conversion has gradually increased to about $3.50 per kgU at the end of December.

There were various causes for the downward pressure on price, including sales of existing UF_6 inventories, drawdown of utility inventories, and, to a lesser degree, the appearance of uranium feed supplies from the HEU Agreement. Although large quantities of conversion services from the HEU Agreement could be perceived to overhang the market, the actual quantities sold to date have been limited. The quantities sold pursuant to the HEU Agreement equate to an annual average of 4.7 percent of U.S. demand for conversion services.

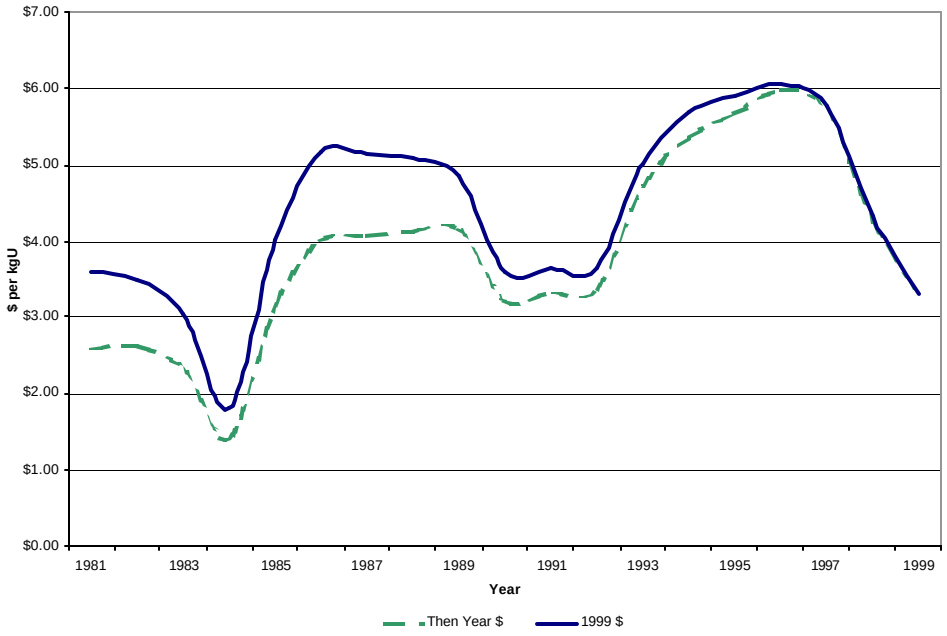

Figure 3–1. Average Annual Conversion Prices in the United States (1981-1999)

13 Monthly uranium conversion spot-market prices from the Uranium Exchange Company.

During 2000, Western conversion capacity was at 81 percent, with ConverDyn only using approximately 73 percent of its capacity. Although current capacity is actually in balance with demand, due to the low spot-market price for conversion services and the plentiful inventories available, the remaining demand is being filled by inventories.

If the only U.S. converter were to fail, then the market price for conversion services would be expected to increase dramatically due to the initial loss of supply. This increased price, in combination with potential increases in transportation costs[14] for U.S. utilities, could impact U.S. energy security.

3.2 Why Is It Important for the United States to Maintain a Conversion Industry?

A viable domestic conversion industry:

- Provides an integrated domestic supply source to meet U.S. utility nuclear fuel requirements.
- Avoids over reliance on foreign sources of nuclear fuel supply, helps to maintain fair pricing by foreign suppliers, and increases assurance of supply.
- Provides a key element that facilitates the successful implementation of the HEU Agreement.
- Reduces fuel costs of U.S. nuclear utilities by facilitating exchanges of feed material that minimize transportation costs.
- Increases safety by reducing uranium cylinder handling.
- Helps provide assured operation of U.S. enrichment plants, as 60 percent of uranium feed delivered to USEC is from the domestic convertor. In the case of a foreign supply disruption, a domestic convertor can help maintain a secure source of supply to USEC.
- Provides positive earnings important to the U.S. balance of trade.
- Provides excellent U_3O_8 storage capacity.

3.3 Proposed Assistance to Industry Reviewed by the Department[15]

Over the past year, the Department has reviewed and considered many alternatives with the goal of maintaining a viable domestic uranium mining and conversion capability. Under any of these alternatives, Government assistance is

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[14] Other primary Western converters are located in Europe and Canada.

[15] While all options were analyzed and considered, not all options were recommended for implementation. Please see section 5 for the Department's recommended actions.

recommended to be provided only until the market conditions could sustain a viable convertor and reliable supply source. Proposals considered to date include:

- Reducing the supply of uranium and conversion services entering the market from the U.S. Government, including delaying the commercial sale of surplus inventories and the congressionally mandated sale of the natural uranium feed component from the HEU Agreement pursuant to provisions of the Privatization Act (remaining amount is about 9.8 million pounds of natural UF_6).

- Using the Department's surplus UF_6 inventories to help the domestic industry meet existing and new sales of U.S. uranium and conversion services.

- Government purchase of services from the domestic convertor to facilitate implementation of the HEU Agreement. This would ensure the domestic capability is there to separate the LEU into the enrichment and natural UF_6 components as required by the HEU Agreement.

- Government financial assistance to the domestic convertor for a short period to bridge the gap until market prices increase to the point of supporting a viable future U.S. conversion industry. This approach would be based upon cost versus sales price, and the duration of the assistance could be tailored to coincide with the completion of sales by USEC of surplus uranium inventories. The conversion industry is well positioned to remain a reliable and competitive supplier in the world market if oversupply conditions are relieved over the next couple of years. In this respect, the industry has already begun to see the market rebound favorably over the last several months as evidenced by the price for conversion rising from a low of $2.35 per kgU to its current price of $3.50 per kgU.

- Purchase by the Government of remaining USEC uranium inventories, including the conversion component since the uranium is in the form of UF_6, for storage by DOE for a five year period. The uranium and the conversion component would then be resold into the market in a reliable, low-volume manner, thus allowing market prices to recover in an orderly manner.

4 COMMENTS AND SUGGESTIONS FROM INDUSTRY

In the preparation of this report, the Department has received input from several sectors of the nuclear fuel cycle. The views expressed to the Department came from the domestic utility industry as well as domestic and foreign uranium mining and conversion industries and the Nuclear Energy Institute.

The views received from industry vary widely, as expected, depending upon their position within the nuclear fuel cycle market. However, there are some common beliefs that were evident from most or all of the input received from industry. These common beliefs include:

- While the HEU Agreement provides for large quantities of uranium, conversion and enrichment entering the marketplace (very little material has entered the market to date, but nearly 400 million pounds of uranium are involved over the twenty year period of the HEU Agreement), the HEU Agreement is necessary and vital to national security and meeting U.S. nonproliferation objectives. As such, every effort should be made to ensure successful implementation of the HEU Agreement.

- Actions taken by the U.S. Government to transfer large quantities of uranium to USEC and USEC's rate of liquidation of the uranium hexafluoride into the market have contributed to the depressed uranium and conversion markets.

- U.S. energy security would be affected by the loss of a domestic uranium enrichment supplier.

- Notwithstanding the successful HEU Agreement implementation, no further government action should be taken to place surplus uranium into the market place.

- The nuclear fuel market is global in nature. Therefore, any uranium, conversion or enrichment placed into the market, even the foreign market, will affect domestic suppliers of nuclear fuel services. Conversion levels at Converdyn were closely tied to USEC market share.

- Key issues that affect the U.S. mining industry include costs and the lead-time associated with permitting new in-situ leach projects and environmental restoration criteria.

5 CONCLUSIONS AND RECOMMENDATIONS RELATED TO SUSTAINING THE DOMESTIC URANIUM MINING, CONVERSION, AND ENRICHMENT INDUSTRIES

The domestic uranium mining, conversion, and enrichment services industries continue to experience downward pressure on prices and depressed market conditions. A number of parties have attributed this downturn to deliveries and sales resulting from the HEU Agreement, . However, these market declines cannot be solely attributed such deliveries and sales. To date, only a small quantity of the natural uranium and conversion services associated with this HEU Agreement have actually entered the market, and the enrichment services component has been introduced into the market on an orderly basis and in a manner that was widely anticipated by the market.

Although the HEU Agreement is partially responsible for reductions in employment at the GDPs and the decision on the part of USEC to shut down the Portsmouth GDP in June 2001, it is not the only factor. In fact, USEC was aware of the extent of the SWU delivery commitments when it was privatized in July 1998 and still believed that it would need to operate both GDPs through 2004. Other factors that contributed to the decision to shut down Portsmouth include a more competitive enrichment market than originally anticipated that has forced USEC to quickly reduce costs to improve efficiencies, as well as changing USEC management decisions. Moreover, the strength of the U.S. dollar has continued to provide foreign enrichment suppliers with a competitive edge, especially in the U.S. market, further pushing the market price downward.

On October 6, 2000, Energy Secretary Richardson announced the Administration's plans to address the long-term concerns associated with sustaining a viable uranium enrichment industry by building an advanced centrifuge demonstration plant at Portsmouth. In the short term, the Administration has announced plans to place the Portsmouth GDP on cold standby for a 5-year period. This will allow the GDP to be restarted in the event of a significant disruption in the nation's supply of enriched uranium. Both of these actions are considered essential to long-term U.S. energy security. They will preserve skills necessary to provide the United States with a new enrichment technology to compete competitively in the market well into the 21st century.

The Department continues to review proposals related to the long-term viability of the domestic uranium mining and conversion industries. We have worked with Congress and industry to analyze all options to help ensure the viability of these vital industries.

Resolution of the natural uranium feed issue associated with the HEU Agreement is expected to have a positive impact on the market. First, DOE's purchase of the natural uranium component from the 1995–1998 deliveries under the HEU Agreement and DOE's agreement to stockpile 58 million pounds of uranium for 10 years are expected to help the market.

Based upon the Department's review of the uranium and conversion industries as well as the input received from Congress and industry, the following recommendations are forwarded by the Department:

- Section 3112 of the USEC Privatizaion Act be amended to avoid the requirement for the near- term sale of the Department's remaining inventories associated with the 1995 and 1996 natural uranium component of the HEU Agreement deliveries. This action would eliminate the need to place approximately 9.8 million pounds of natural UF_6 into an already depressed market by April 2003. This action would be consistent with actions already taken by Congress and the Administration to remove 58 million pounds from the market over the next ten years.

- Consistent with the legislative objectives to ensure reliable and competitive domestic mining, conversion and enrichment industries, consider promptly limited financial assistance to ConverDyn. This assistance, which would be capped in annual amount and in length of time over which it is provided, would be derived through an assessment of actual costs versus prices received from existing and new contracted sales. The payment provisions of this initiative would help ensure the maintenance of the only U.S. supplier of conversion services and incentivize new production and sales.

- Establish a cooperative effort between DOE and the uranium industry to identify, test and develop low-cost environmental restoration technology for uranium mining and cleanup activities. Funding for this effort will be determined through congressional appropriations.

- Recognizing the vital importance of the nuclear fuel cycle to U.S. energy security, the Department establish the Office of Nuclear Fuel Cycle Security with the following goals and objectives:

  - Provide leadership and expertise on nuclear fuel cycle policy; including expert analysis and advice on uranium, conversion and enrichment markets; sales; asset management; and security of domestic supply.

  - Manage enrichment technology activities for commercial and government purposes, including those related to the advanced gas centrifuge demonstration program.

  - Manage activities required to place the Portsmouth GDP in a cold standby condition.

  - Continue to work with Congress and industry to reach conclusion on the ability to provide the near-term assistance required by the domestic uranium and conversion industries.